

WHAT IS CLAIMED IS:

1. In combination with a spindle having a hub rotating on bearings and coupled to a rotating member, a telemetry assembly coupled to the spindle, the telemetry assembly comprising:
  - a wireless transmitter coupled to the hub to rotate therewith;
  - a receiving antenna wirelessly coupled to the transmitter; and
  - a guiding system coupled to the wireless transmitter and the receiving antenna to guide rotation of the wireless transmitter relative to the receiving antenna, the guiding system having a central aperture through which at least one of the spindle and the rotating member extends.
2. The combination of claim 1 wherein the receiving antenna comprises an arced assembly disposed about a spindle axis of the spindle.
3. The combination of claim 1 wherein the transmitter is disposed proximate the receiving antenna and travels in a circular path similar to the receiving antenna, which is held stationary relative to the transmitting antenna in at least one translation and rotation other than rotation about the spindle axis.

4. The combination of claim 3 and further comprising:  
a rotor housing supporting the transmitter and  
coupled to the hub to rotate therewith;  
a stator housing supporting the receiving antenna;  
and  
a connection assembly coupled to the stator  
housing and a non-rotating element of the  
spindle to inhibit rotation of the stator  
housing.

5. The combination of claim 4 wherein the connection  
assembly comprises:  
an elongated member secured to the non-rotating  
element;  
a ball receiver having a cavity and secured to the  
telemetry assembly; and  
a ball coupled to the elongated member and  
disposed within the cavity of the ball  
receiver.

6. The combination of claim 4 wherein the connection  
assembly comprises a strap.

7. The combination of claim 4 wherein the stator  
housing is disposed between the connection assembly and  
the rotor housing.

8. The combination of claim 1 and further comprising  
a wireless power coupling including a first component

mounted to the stator housing and a second component mounted to the rotor housing.

9. The combination of claim 1 and further comprising an angular sensing device operably coupled to the rotor housing and the stator housing.

10. The combination of claim 1 wherein the spindle comprises a rim and the telemetry assembly is spaced apart from the rim.

11. The combination of claim 1 wherein the spindle comprises a spindle bearing and wheel assembly, and the telemetry assembly is spaced concentrically with the spindle bearings.

12. The combination of claim 1 and further comprising a transducer mounted to the hub to rotate therewith and wherein the telemetry assembly is disposed between the hub and the transducer.

13. The combination of claim 1 wherein the rotating member is a hub adapter mounted to the hub to rotate therewith.

14. A spindle mountable telemetry assembly for use on a spindle coupled to a rotating member, the telemetry assembly comprising:

a wireless transmitter;

2025 RELEASE UNDER E.O. 14176

a receiving antenna operable with the transmitter;  
a first housing supporting the receiving antenna;  
a second housing rotatable about an axis and  
relative to the first housing wherein the  
second housing supports the wireless  
transmitter; and  
a guiding system coupled to the first housing and  
the second housing to maintain position and  
guide rotation of the second housing  
relative to the first housing, the guiding  
system and housings including apertures  
adapted to allow extension of at least one  
of the spindle and the rotating member  
therethrough.

15. The telemetry assembly of claim 14 wherein the  
guiding system includes a bearing pad and a bearing  
race having a guided groove, wherein the bearing pad is  
disposed in the guided groove to maintain position and  
allow rotation of the second housing relative to the  
first housing.

16. The telemetry assembly of claim 15 and further  
comprising a plurality of bearing pads disposed in the  
guided groove.

17. The telemetry assembly of claim 14 wherein the  
guiding system includes ball bearings coupled to the  
first and second housings.

2025 RELEASE UNDER E.O. 14176

18. The telemetry assembly of claim 14 wherein the first and second housings comprise annular rings.

19. The telemetry assembly of claim 18 and further comprising a connection assembly secured to the first housing and mountable to a non-rotating element of the spindle.

20. The telemetry assembly of claim 19 wherein the first housing is disposed between the connection assembly and the second housing.

21. The telemetry assembly of claim 18 wherein the rings are concentric.

22. The telemetry assembly of claim 14 and further comprising seals disposed about the guiding system.

23. The telemetry assembly of claim 22 wherein the seals comprise synthetic material.

24. The telemetry assembly of claim 22 wherein the seals comprise polypropylene material.

25. The telemetry assembly of claim 22 wherein the seals comprise aramid material.

2025 RELEASE UNDER E.O. 14176

26. The telemetry assembly of claim 14 and further comprising an angular sensing device operably coupled to the first and second housings.

27. The telemetry assembly of claim 26, wherein the angular sensing device senses position of the second housing relative to the first housing and provides quadrature feedback indicative of angular position and direction of rotation of the second housing.

28. The telemetry assembly of claim 26 wherein the angular sensing device comprises an indicator and an optical sensing device to sense the presence of the indicator.

29. The telemetry assembly of claim 14 and further comprising a wireless power coupling comprising a first coil coupled to the first housing and a second coil coupled to the second housing.

30. The telemetry assembly of claim 14 and further comprising a power cell rotatable with and powering the wireless transmitter.

31. The telemetry assembly of claim 14 wherein the guiding system comprises phenolic.

32. The telemetry assembly of claim 14 wherein the guiding system comprises polyaryletheretherketone (PEEK).

33. The telemetry assembly of claim 14 wherein the guiding system comprises a polyimide resin.

34. The telemetry assembly of claim 14 wherein the guiding system comprises stainless steel.

35. The telemetry assembly of claim 14 wherein the guiding system comprises a synthetic resin.

36. The telemetry assembly of claim 14 wherein the guiding system comprises a graphite filled resin.

37. The telemetry assembly of claim 14 wherein the guiding system comprises a hard-coated material.

38. A telemetry system for a spindle, the telemetry system comprising:

- a hub adapter mountable to the spindle;
- a transducer mountable to the hub adapter;
- a telemetry assembly mountable to a side of the transducer facing the hub adapter, the telemetry assembly comprising a stator portion supporting a receiving antenna, a rotor portion secured to at least one of the transducer and the hub adapter, the rotor

2022016643001

portion being rotatable about an axis and relative to the stator portion, and a guiding system coupled to the stator portion and the rotor portion to guide rotation of the rotor portion relative to the stator portion; and

a wireless transmitter coupled to the stator portion and receiving signals from the transducer and having a transmitting antenna operable with the receiving antenna.

39. The telemetry system of claim 38 and further comprising an angular sensing device operably coupled to the rotor portion and the stator portion.

40. The telemetry system of claim 38 wherein the rotor portion is disposed between the stator portion and the transducer.

41. The telemetry system of claim 38 wherein the rotor portion faces the stator portion and is rotatable in a circular path substantially similar to the stator portion.

42. The telemetry system of claim 41 wherein the guiding system includes a central aperture adapted to allow extension of at least one of the spindle and a rotating member coupled to the spindle therethrough.

20252015EE0001

43. The telemetry system of claim 38 and further comprising a wireless power coupling to power the wireless transmitter, the wireless power coupling comprising a first coil mounted to the stator portion and a second coil mounted to the rotor portion.

44. In combination with a spindle having a hub rotating on bearings and coupled to a rotating member, a telemetry assembly coupled to the spindle, the telemetry assembly comprising:

- a first housing having a data receiver;
- a second housing having a data transmitter coupled to the data receiver;
- means for guiding the second housing relative to the first housing; and
- means for connecting the first housing to a non-rotating element of the spindle.

45. The telemetry system of claim 44 and further comprising:

- means for sensing an angular position of the second housing relative to the first housing.

46. The telemetry system of claim 44 and further comprising:

- means for inhibiting translational motion of the first housing relative to the second housing.

means for inhibiting rotational motion of the first housing relative to the second housing in all axis other than the axis of rotation allowed by the means for guiding.

47. The telemetry system of claim 44 and further comprising:

means for maintaining a gap between the data receiver and the data transmitter.